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(19)(CA) APPLICATION FOR CANADIAN PATENT (12)

(54) Safety Lock Pin

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(71) Quality Steel Foundries Ltd. - Canada ;

(57) 29 Claims

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Abstract

The present invention is a point and adaptor assembly comprising an excavation point, adaptor, and coupling means. The coupling means comprises a sleeve receivable within the adaptor, pin means receivable through pin openings in the point and threaded into the insert sleeve. The pin is locked in place by a lock ring mechanism. The invention also includes a method for installing the point on the adaptor.

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SAFETY LOCK PIN FOR EXCAVATION POINT AND ADAPTOR

Field of the Invention

This invention relates to the field of excavating teeth and in particular to assemblies for attaching a ground engaging tooth to an adaptor on an excavating tool.

Background of the Invention

At approximately the turn of the 20th century, excavating tools employed excavating teeth with replaceable ground engaging tips known as points. The points were connected to an adaptor attached to the shovel dipper, drag-line bucket or similar tool. An example is disclosed in U.S. Patent No. 564,664. As the two part assembly became established practice, a number of methods evolved for joining the point to the adaptor. Depending on the mine conditions, a given adaptor would be successively re-equipped with 5 to 30 teeth or points to maintain a sharp penetrating edge during excavation. The ease of replacement of the point became important because it minimized the amount of wasted throw-away metal and also minimized the down time of the tool.

The assemblies used to attach a point to the adaptor consisted mainly of two designs, the wedge design and the pin design. In the wedge design, the point is joined to the adaptor by wedges hammered in place. One disadvantage of this method is the wedges would often become dislodged during use of the excavating tool. This design posed serious safety hazards to workers. To prevent this danger, the wedges were often tack-welded in place. However, removal of the wedges was then difficult and time consuming. Another disadvantage of this method is that the removal of the wedge requires the drag-line bucket to be turned up on its front end in order to gain access to the wedge.

U.S. Patent No. 3,256,622 describes a wedge pin assembly used to fasten a point to the adaptor. The wedge pin is

9. Coupling means according to claim 8 wherein said ring groove on said pin is located adjacent to the widest end of said tapered portion.

10. Coupling means according to claim 1 or 2 wherein said sleeve and said pin are located at or near the center axis of inertia of said adaptor.

11. Coupling means according to claim 1 or 2 comprising two sleeves and two pins.

12. An excavation tooth assembly comprising an adaptor having at least one opening therein; a point removably coupled to the forward end of said adaptor and having at least one opening smaller than and aligning with said opening in said adaptor; at least one sleeve receivable within said adaptor opening held in a non-rotational position and maintained within said opening by the wall of said point; and at least one pin receivable through said opening in said point and into said sleeve whereby at least part of said pin is retained within said point.

13. An excavation tooth assembly according to claim 12 further comprising an expandable lock ring.

14. An excavation tooth assembly according to claim 12 or 13 wherein said sleeve is internally threaded.

15. An excavation tooth assembly according to claim 13 wherein said sleeve has a ring cavity therein.

16. An excavation tooth assembly according to claim 15 wherein said ring cavity has an inwardly directed lip around its inner rim, said lip having a minimum diameter slightly less than the unstressed diameter of said lock ring, but greater than the compressed diameter of said lock ring.

17. An excavation tooth assembly according to claim 14 wherein said pin has a threaded lower portion.

18. An excavation tooth assembly according to claim 17 wherein said pin has an outwardly tapered portion above the threads of said pin.

19. An excavation tooth assembly according to claim 13 or 15 wherein said pin has a ring groove having a depth of up to approximately one-half the thickness of said lock ring.

20. An excavation tooth assembly according to claim 19 wherein said ring groove on said pin is located adjacent to the widest end of said tapered portion.

21. An excavation tooth assembly according to claim 12 or 13 wherein said sleeve and said pin are located at or near the center axis of inertia of said adaptor.

22. An excavation tooth assembly according to claim 12 or 13 comprising two sleeves and two pins.

23. Method of locking a point to an adaptor comprising the steps of inserting a sleeve having a ring cavity into an opening in the adaptor in a non-rotational position, placing an expandable lock ring in said ring cavity of said sleeve, placing the point having an opening aligning with said sleeve onto the forward end of the adaptor, inserting a tapered pin having a ring groove through said opening in the point and through said lock ring into said sleeve whereby said pin extends from within said point into said sleeve and whereby about half of the thickness of said lock ring is retained within said ring groove in said pin thereby locking the point onto the adaptor.

24. Method of locking a point to an adaptor according to claim 23 wherein said sleeve is internally threaded.

25. Method of locking a point to an adaptor according to claim 24 wherein said pin has a threaded lower portion.

26. Method according to claim 23 wherein said ring groove on said pin is located adjacent to the widest end of said tapered portion.

27. Method according to claim 23 wherein said ring cavity has an inwardly directed lip around its inner rim, said lip having a minimum diameter slightly less than the unstressed diameter of said lock ring, but greater than the compressed diameter of said lock ring.

28. Method according to claim 23 wherein said sleeve and said pin are located at or near the center axis of inertia of said adaptor.

29. Method according to claim 23 comprising two sleeves and two pins.

2161505

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The assemblies used to attach a point to the adaptor consisted mainly of two designs, the wedge design and the pin design. In the wedge design, the point is joined to the adaptor by wedges hammered in place. One disadvantage of this method is the wedges would often become dislodged during use of the excavating tool. This design posed serious safety hazards to workers. To prevent this danger, the wedges were often tack-welded in place. However, removal of the wedges was then difficult and time consuming. Another disadvantage of this method is that the removal of the wedge requires the drag-line bucket to be turned up on its front end in order to gain access to the wedge.

U.S. Patent No. 3,256,622 describes a wedge pin assembly used to fasten a point to the adaptor. The wedge pin is

received into an open-ended slot. The wedge pin is removed by being hammered through the slot with a specially designed hammer having a head size smaller than the slot size. The wedge pin is designed to cause interference in the slot but still be removable. One disadvantage of this arrangement is the tendency of the wedge to shatter or break during removal causing pieces to jam as well as dangering workers.

U.S. Patent No. 4,326,348 discloses a pin design incorporating a pin and lock washer. The lock washer ensures the pin does not dislodge during service. The adaptor and the point have openings which accommodate the pin and the lock washer. The lock washer is placed overtop the adaptor pin hole and the point is placed in position on the adaptor with the pin holes in line. Once the holes in the adaptor and point line up, the pins are hammered into place. The pins are removed by further hammer driving. A common criticism with this device is that it is difficult to remove the pins because of the impact fines and the tight tolerances between the adaptor and the point.

Another pin assembly is disclosed in Canadian Patent Application No. 2,121,993. This patent discloses a threaded pin and insert assembly to secure a point onto the adaptor. A threaded insert is placed into the adaptor pin opening. The point is then placed over the adaptor. A lock washer is concentrically placed over the pin opening on the point. The pin is screwed into the insert. Disadvantages of this assembly include the loosening of the pin from the insert while the point-adaptor assembly is in use and the cumbersome and relatively complex design. A work accident may occur during the assembly and disassembly of the pieces. Furthermore, the point replacement time is longer than with more conventional teeth.

Generally locking devices are designed to minimize the down time of the equipment and increase the life of the point and adaptor. With the increase in awareness of worker safety,

another important requirement of the point-adaptor assembly is a safe and easy-installation.

Summary of the Invention

The present invention overcomes the disadvantages of the prior art and provides a point and adaptor assembly secured by a pin and lock assembly.

It is an object of the present invention to provide a point and adaptor assembly in which the point will not become disengaged from the adaptor during use.

It is a further object of the present invention to provide a method for assembling and disassembling a point to an adaptor.

According to the present invention then there is provided a coupling means for an excavation tooth assembly for removably retaining an excavation point onto an adaptor comprising at least one sleeve receivable within the adaptor, said sleeve being held in a non-rotational position, and at least one pin receivable within said sleeve and at least partially retained within said point for coupling the point to the adaptor.

The present invention also provides an excavation tooth assembly comprising an adaptor having at least one opening therein; a point removably coupled to the forward end of said adaptor and having at least one opening smaller than and aligning with said opening in said adaptor; at least one sleeve receivable within said adaptor opening held in a non-rotational position and maintained within said opening by the wall of said point; and at least one pin receivable through said opening in said point and into said sleeve whereby at least part of said pin is retained within said point.

The present invention also relates to a method of locking a point to an adaptor comprising the steps of inserting a sleeve having a ring cavity into an opening in the adaptor in a non-rotational position, placing an expandable lock ring in

said ring cavity of said sleeve, placing the point having an opening aligning with said sleeve onto the forward end of the adaptor, inserting a tapered pin having a ring groove through said opening in the point and through said lock ring into said sleeve whereby said pin extends from within said point into said sleeve and whereby about half of the thickness of said lock ring is retained within said ring groove in said pin thereby locking the point onto the adaptor.

Brief Description of the Drawings

Preferred embodiments of the present invention will now be further described and will be better understood when read in conjunction with the drawings in which:

Figure 1 is a plan view of one embodiment of the point and adaptor assembly.

Figure 2 is a sectional view taken along axis A-A in Figure 1.

Figure 3 is a cross sectional view taken along axis B-B in Figure 1.

Figure 4 is a plan view of the pin assembly shown in Figure 1.

Figure 5 is a cross sectional view taken along axis C-C in Figure 3.

Figure 6 is a plan view of the lock ring shown in Figure 5.

Figure 7 is a front view of the assembly in Figure 1.

Figure 8 is a side view of the assembly in Figure 1.

Description of the Invention

Referring to the drawings, Figures 7 and 8 show a model of one embodiment of the excavation tooth assembly of the present invention. As seen in Figure 1, the present invention comprises an excavation point 3, an adaptor 5 and two pin assemblies 7. The pin assemblies 7 lock the point 3 onto the adaptor 5. One pin assembly 7 is located at each side of the

point 3. The pin assemblies 7 extend through the point 3 and into the adaptor 5. The pin assemblies 7 are preferably located in the ear 9 of the point 3 where the point 3 is thickest and the relative wear loss during use is lowest. This location allows the most material to be worn from the point 3 before the assembly fails in service.

Figures 2 and 3 illustrate the arrangement of the pin assemblies 7 within the point 3 and adaptor 5. The point 3 and adaptor 5 have openings 11, 13 which are adapted to receive the pin assemblies 7. The openings 11, 13 are positioned so that the sleeve 17 is located on the center axis of inertia of the adaptor to minimize point rocking on the adaptor.

The pin assemblies 7 are comprised of a pin 15, sleeve 17, and locking means 19. The sleeve 17 is internally threaded. It is designed to be retained in a non-rotational position within the sleeve receiving opening 13 in the adaptor 5. The outside contours of the sleeve 17 and the sleeve receiving opening 13 are tapered to ensure the sleeve 17 slides easily within the opening 13 and to simplify manufacturing. When the point 3, adaptor 5 and pin assemblies 7 are assembled in an operative position, the sleeve 17 will align with the pin receiving opening 11 in the point 3. The pin 15 is threaded into the sleeve 17. The shoulder 21 of the pin 15 is supported within the pin receiving opening 11 in the point 3. The pin 15 extends from within the sleeve 17 in the adaptor 5 to nearly through the pin receiving openings 11 in the point 3 to prevent the point 3 from disengaging from the adaptor 5 while in service. The pin 15 has a tapered design and is preferably made from a hardened low alloy steel. It has a standard bolt head 45 to assist in inserting and removing the pin from the sleeve. The diameter of the pin 15 must be large enough to support the constant shearing stress between the point 3 and the adaptor 5.

The sleeve 17 is designed to center itself within the sleeve receiving opening 13 and preferably the contours of the sleeve 17 and opening 13 are complementary. The sleeve 17 does not need to fit tightly within the sleeve receiving opening 13 in the adaptor 5. The adaptor 5 is shown in Figure 2 with face contours 25, 26, 27 on the sleeve receiving opening 13 corresponding to the contours of the sleeve 17 to retain the sleeve 17 in position. In Figure 4, the sleeve receiving opening 13 has oval face contours 31, 32, 33, 34 to prevent the sleeve 17 from rotating while the pin 15 is threaded into the sleeve 17. Other embodiments to secure the sleeve 17 in the adaptor and to prevent rotation are contemplated. For example a keyed interlocking arrangement or a threaded connection between the sleeve 17 and adaptor 5 may be used.

The sleeve receiving opening 13 in the adaptor 5 extends through the center of the adaptor 5 to allow for a continuous opening throughout as shown in Figures 2 and 3. This design allows the base of the pin 15 to extend beyond the base 35 of the sleeve 17 without conflicting with the adaptor walls, thereby allowing one pin size to be utilized with a range of point 3 and adaptor 5 sizes. It also simplifies the casting design and improves the casting fitting quality because the mould core aligns on both sides rather than only one side.

When the pin assembly 7 is installed, the inside walls 37, 38 of the point 3 and the outside walls 39, 40 of the center portion of the adaptor 5 fit together. The inner surface 37 of the point 3 overlaps the outside surface 28 of the sleeve 17, thereby retaining the sleeve 17 in place during service. The face plate 29 of the sleeve 17 remains flush or below the adaptor surface 39 to prevent the inside surface 37 of the point 3 from damaging the sleeve 17. The pin receiving openings 11 are perpendicular to the primary wear surfaces 41, 42 to further protect the pin 15 from damage during use of the point 3 and adaptor 5.

As shown in Figure 5, the pin assembly 7 has locking means 19 to retain the pin 15 in the sleeve 17 during service. The locking means 19 includes a lock ring 50. The lock ring 50 shown in Figure 6 has a small opening 58 to allow the ring 50 to expand to fit over the pin shoulder 21 and into the ring groove 52 of the pin 15. After the sleeve 17 is inserted into the sleeve receiving opening 13 in the adaptor 5, the ring 50 is placed into the cavity 55 of the sleeve 17. The cavity 55 is large enough to allow the lock ring 50 to be placed in the cavity but small enough to retain the ring 50 in position over the pin entrance 57 in the sleeve 17. The cavity 55 also prevents the lock ring 50 from contacting the inside surface 37 of the point 3. The point 3 is placed over the adaptor 5. As the pin 15 is inserted into the pin receiving opening 11 through the lock ring 50 and into the pin entrance 57 in the sleeve 17, the expandable lock ring 50 is forced up the tapered shoulder 21 of the pin 15 and into the ring groove 52. The ring groove 52 holds the lock ring 50 in place. Part of the lock ring 50 is positioned within the ring groove 52 and the remaining lock ring 50 is left in the cavity 55. Should the pin 15 loosen during use of the point 3 and adaptor 5, the positioning of the lock ring 50 prevents the pin 15 from backing out the sleeve 17. When the point 3 needs to be replaced, the pin 15 can be removed by applying a strong torque force to the bolt head 45. This force causes the pin 15 to unthread from the sleeve 17. The lock ring 50 is forced against the top of the cavity 55 of the sleeve 17 and will be pushed out of the ring groove 52 and onto the pin shoulder 21 releasing the pin 15.

The present invention also includes the method of joining the point 3 onto the adaptor 5 comprising inserting an internally threaded sleeve 17 into the opening 13 in the adaptor 5; placing an expandable lock ring 50 into the cavity 55 in the sleeve 17; placing the point 3 over the adaptor 5; and threading the pin 15 into the sleeve 17 thereby forcing

the lock ring 50 up the pin shoulder 21 and into the ring groove 52 on the pin 15.

While the invention has been described with reference to one preferred embodiment, those skilled in the art will appreciate that modifications and alterations may be made without departing from the scope of the invention. Therefore, it is intended that the invention should not be limited by the foregoing description.

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FIGURE 1

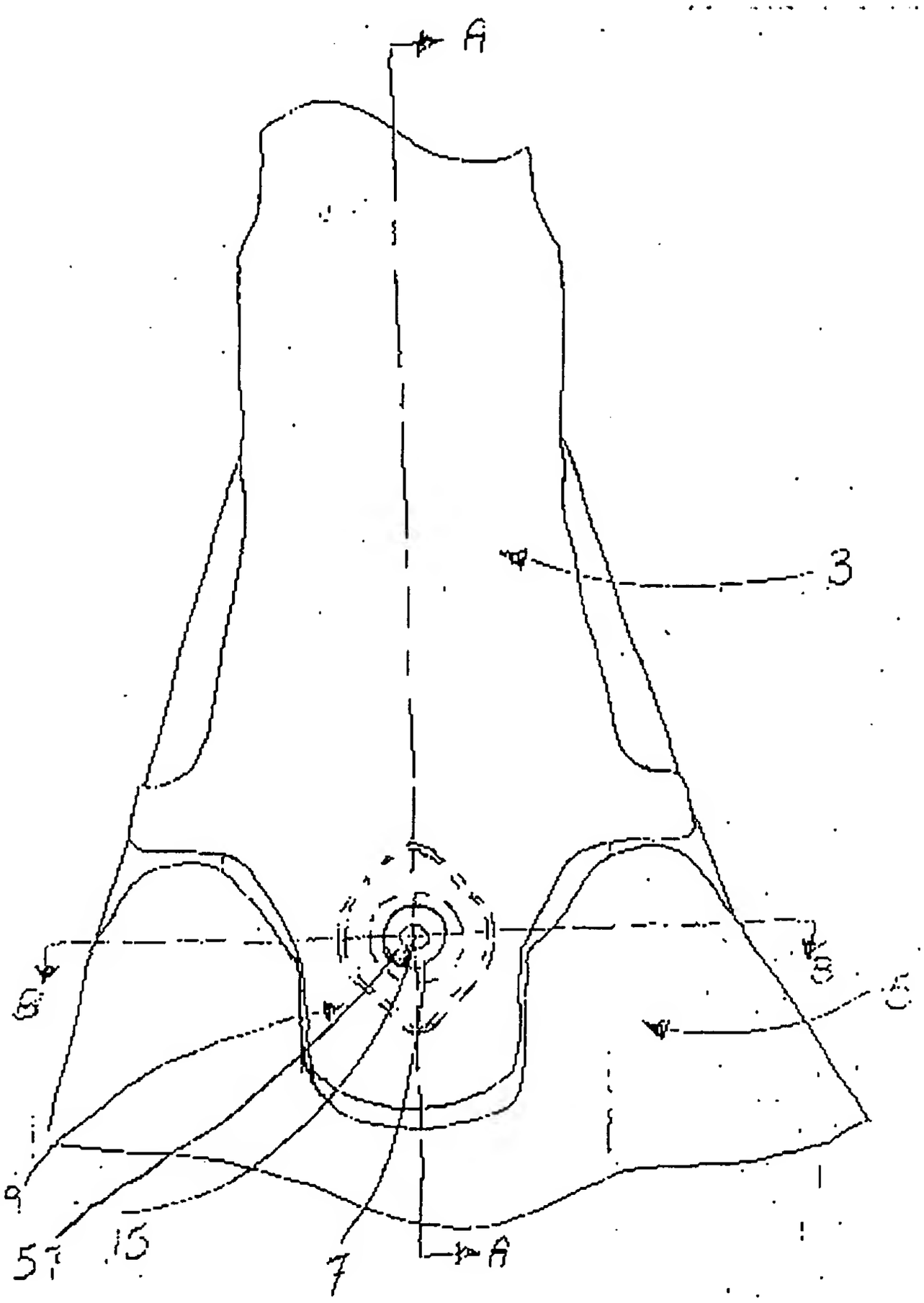

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FIGURE 2

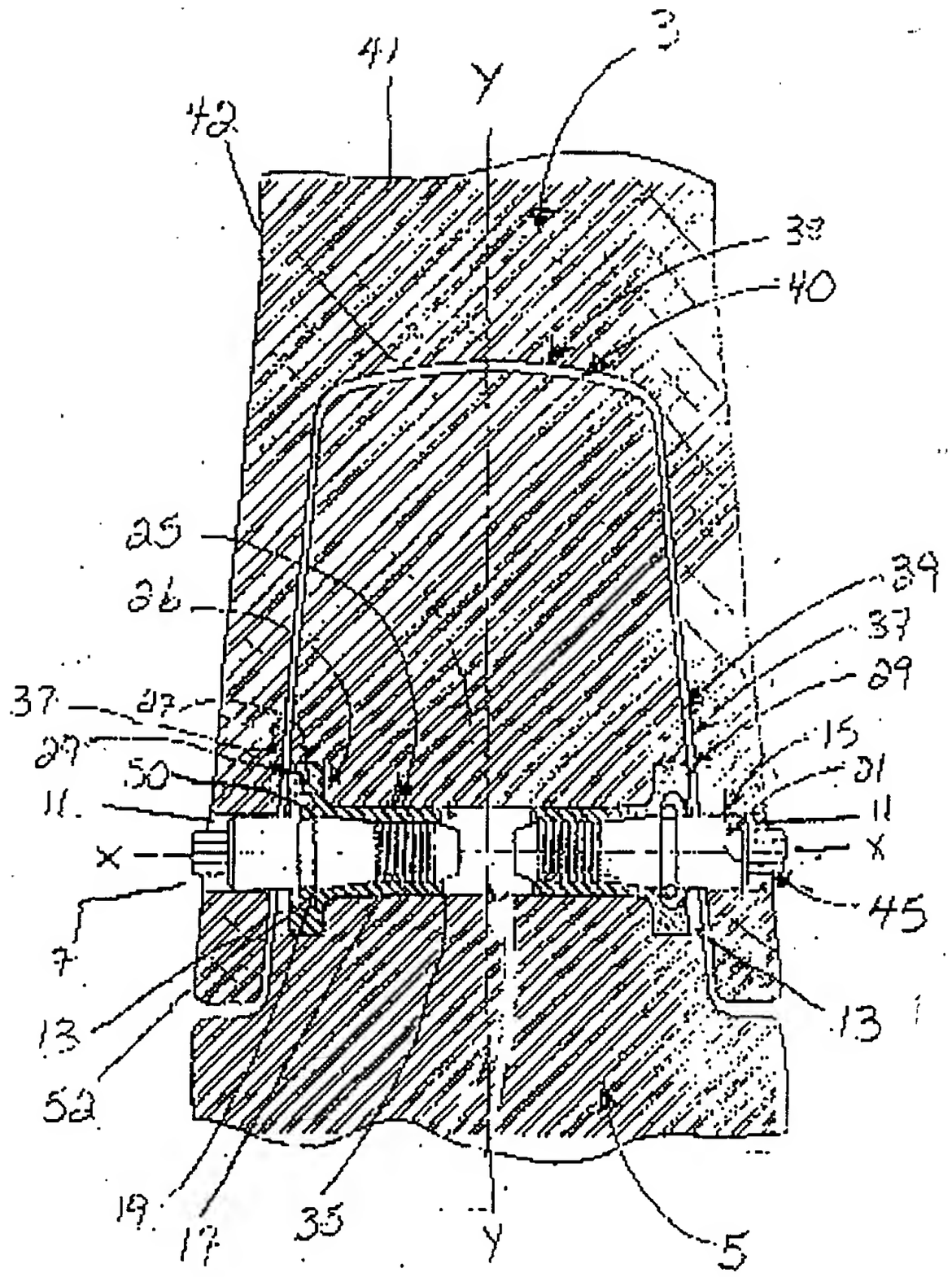

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FIGURE 3

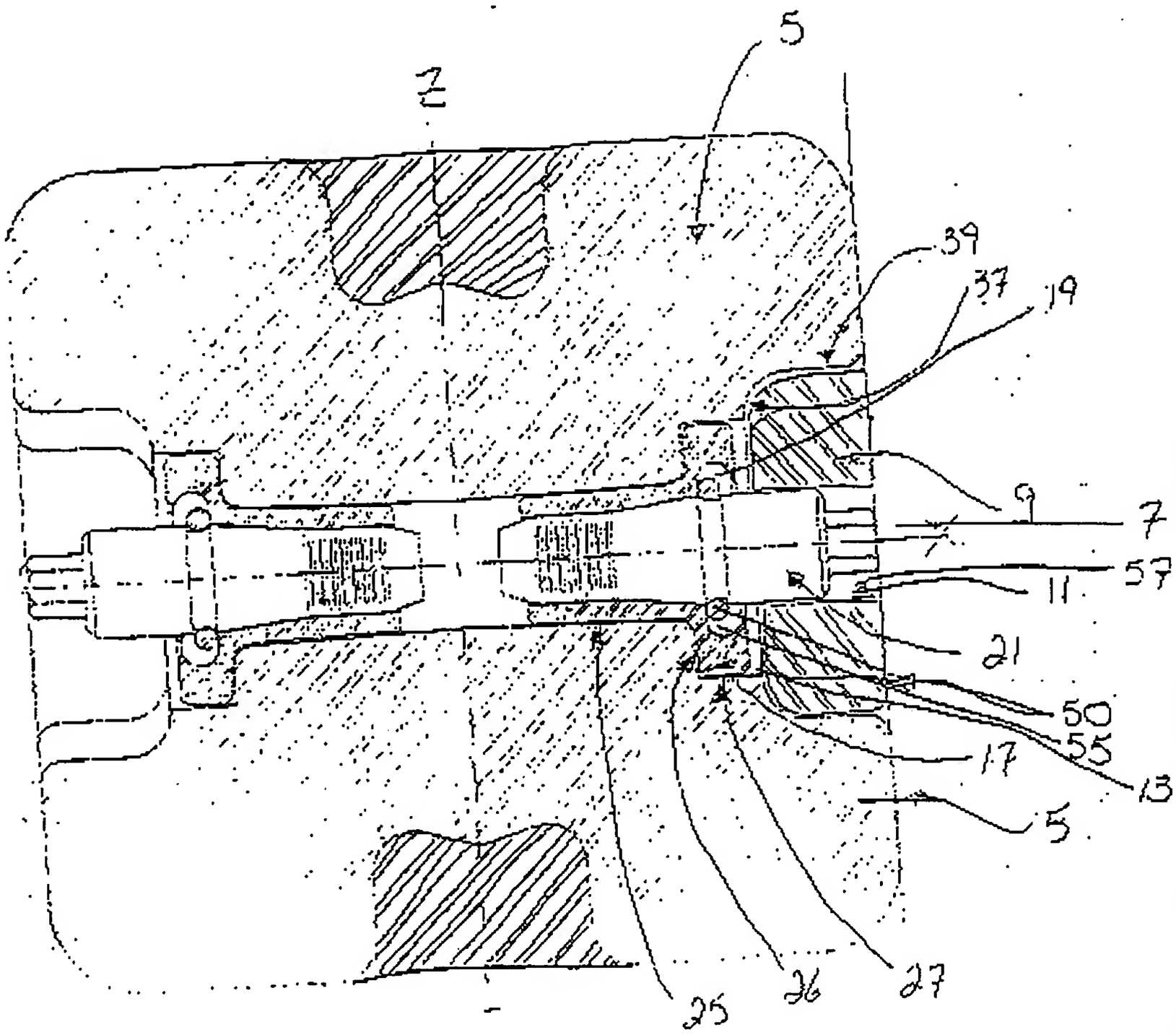

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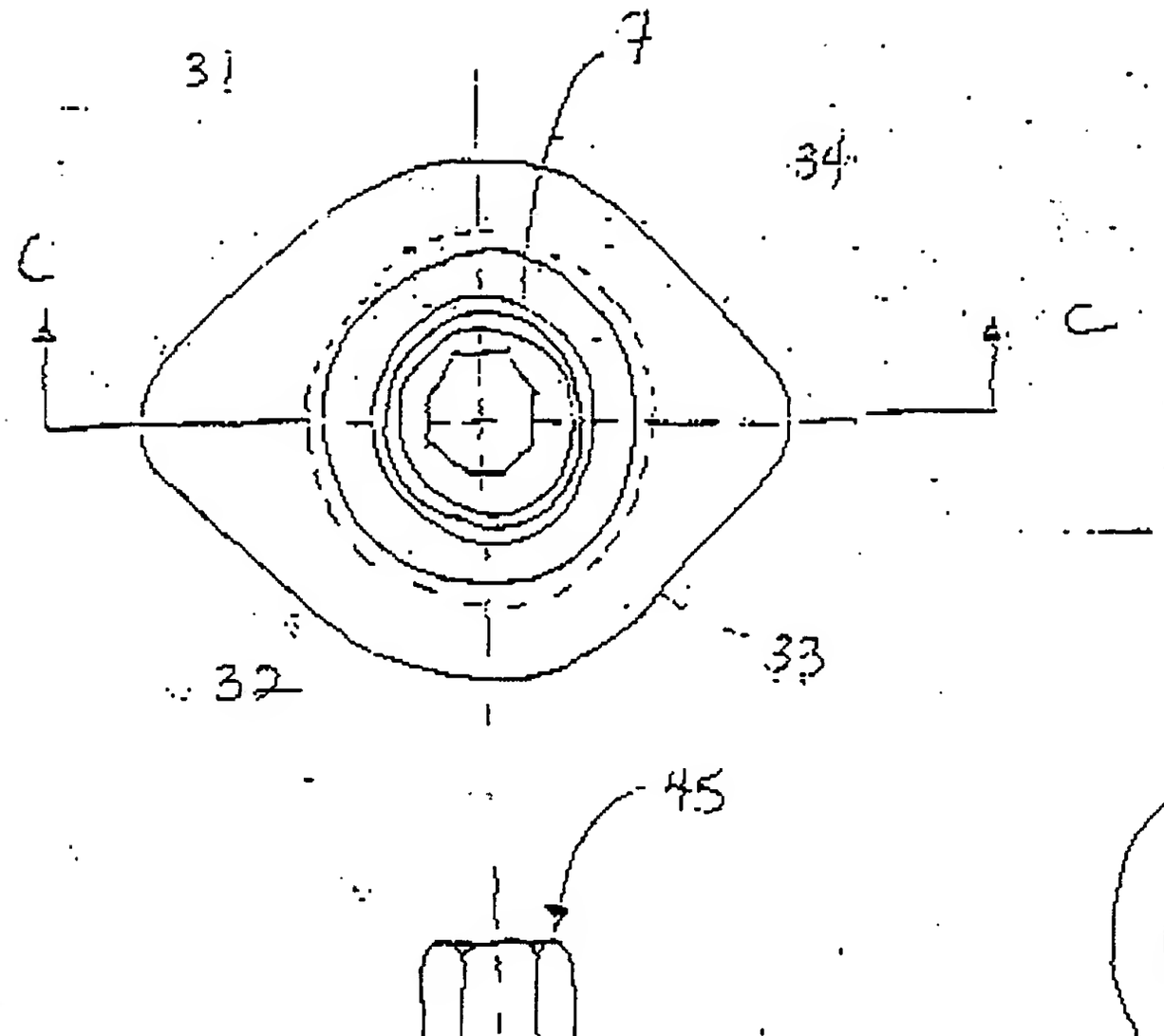
FIGURE 4



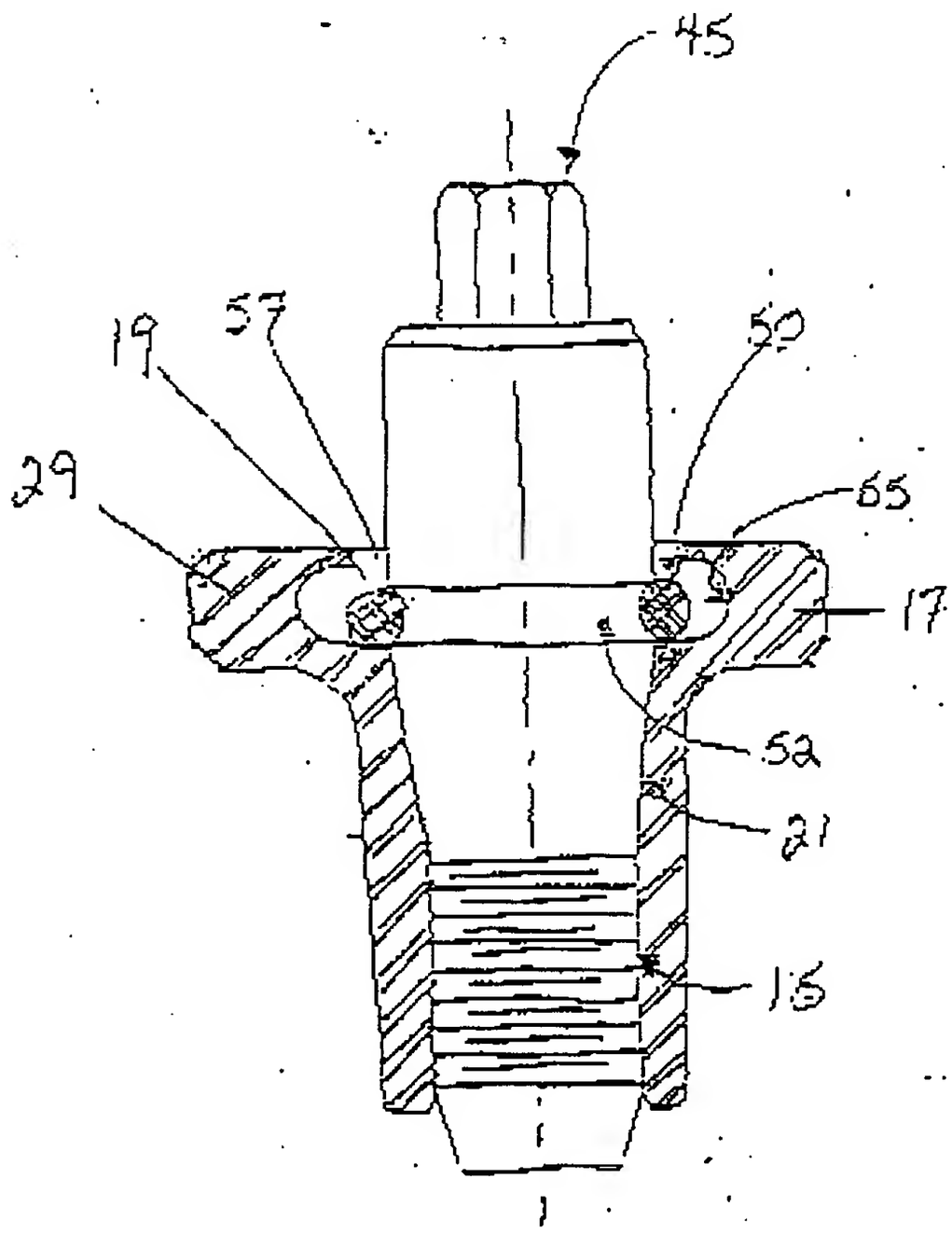


FIGURE 5

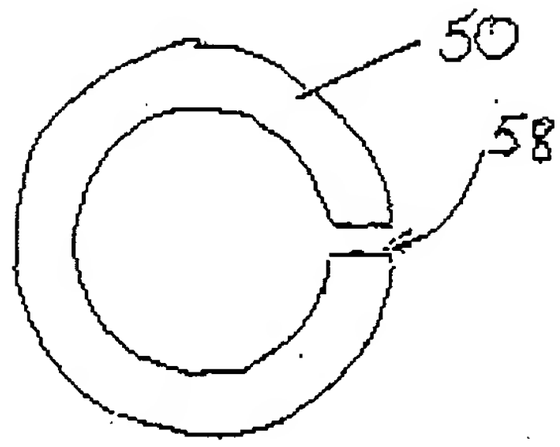


FIGURE 6

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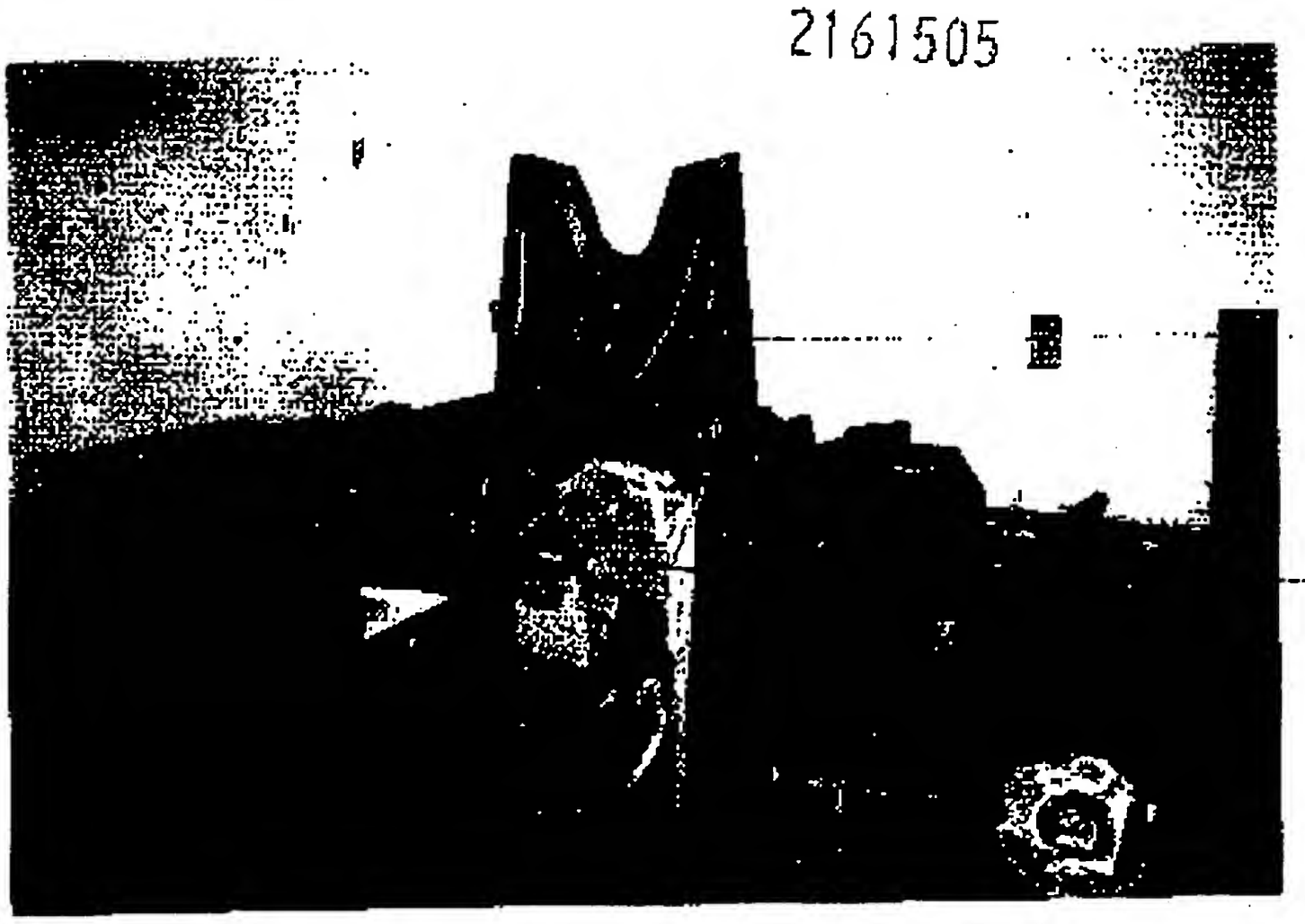


FIGURE 7

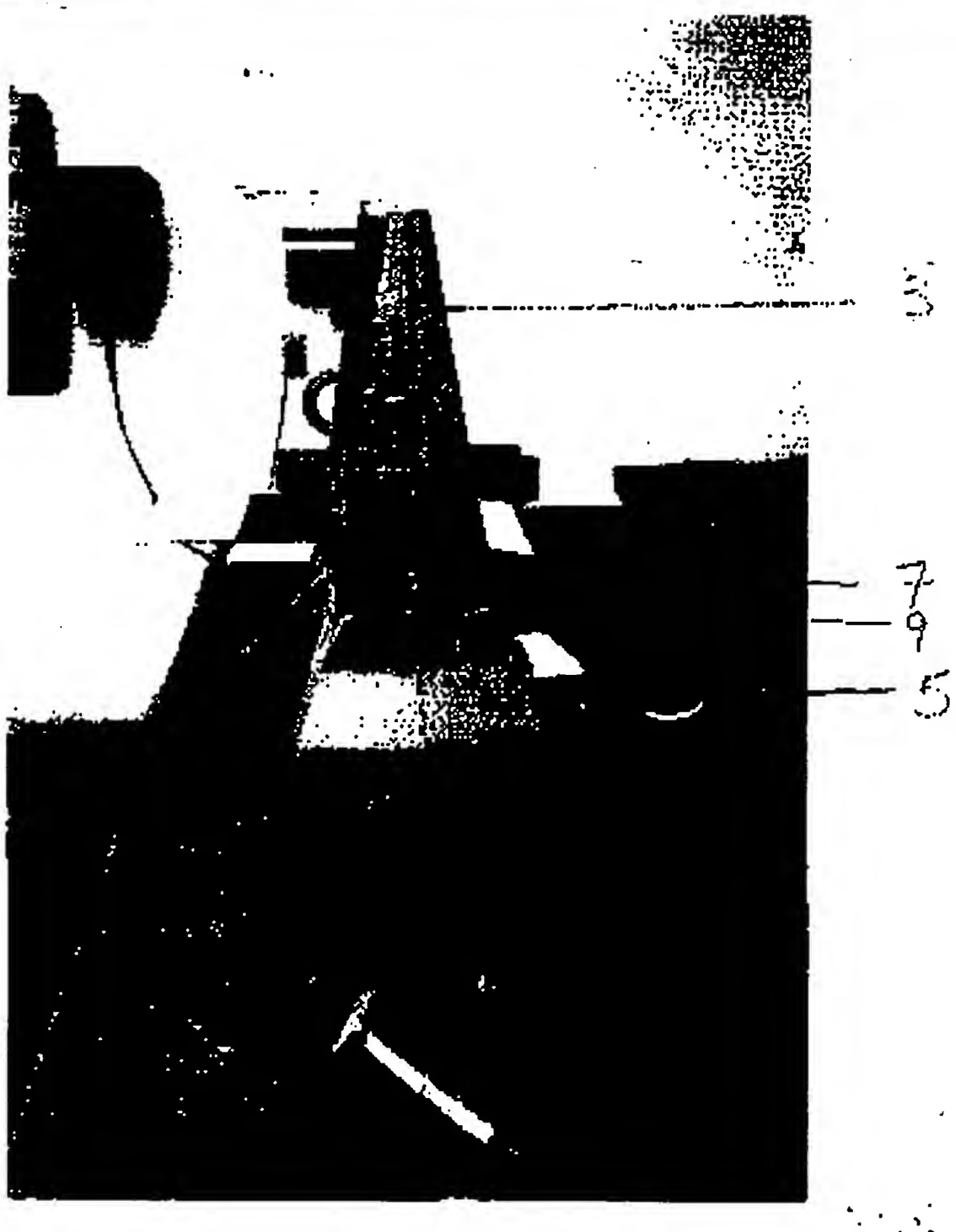
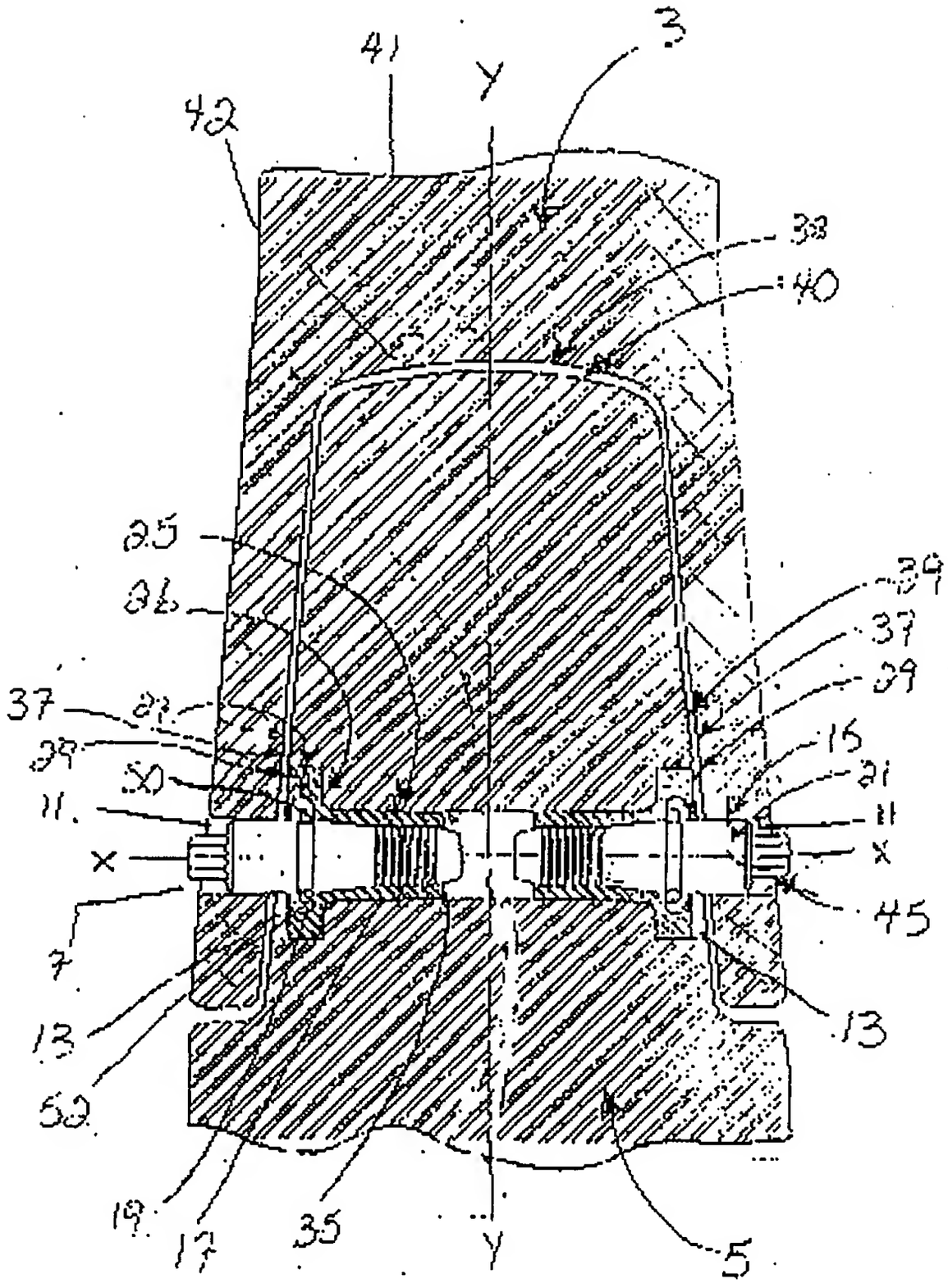


FIGURE 8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